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QOS MODELING AND ANALYSIS USING QML IN MOBILE COMPUTING ENVIRONMENT

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ABSTRACT

Network designing techniques are complex. The QML can help reducing the network design complexity. QML is widely used modeling language in development processes. It is quite adapted for the specification non-functional aspect such as QoS. The overall aim of this research is to perform modeling of the QoS in mobile computing environment using modeling languages QML and analyzing QoS parameters using of tools. A new technique of improving the congestion control of the MANET has been device QoS measurement of the same has been evaluated using the various parameters of the network system measurement. After this modification, it is observed that the performance of the protocol is improved.

KEYWORDS: QML, QoS, MANET & protocol

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Original Article

INTRODUCTION

In present day world, the uses, needs and applications of the mobile networks are on the rise. Emerging technologies lie at the basic heart of these data communications. Mobile and Radio terminal characteristics are responsible for differences between Mobile and Fixed distributed systems. The factors that define a mobile computing system are: application, middleware, operating system (OS), mobile terminal, and mobile communication system. End-to-end quality of service (QoS) in mobile computing systems is therefore the combination of QoS characteristics and QoS mechanisms across the system [Chalmers, D, 1999].

Most of the modern communication systems have dependable message transfer along with control of error and notification of non-delivery. However, the stress upon ensuring timeliness about data delivery has been quite recent development. This is particularly true when focusing on the perceived quality of the data arriving, especially when more complex (multi-)media are being used. The important concepts of bandwidth, throughput, timeliness (including jitter), reliability, perceived quality and cost are the conerstones of what is defined as Quality of Service (QoS).

QOS AND MOBILE COMPUTING

Functional aspects of software performance is at the core of focus for software developers. This is easily understandable since the software they produce must perform as per expectations. Additionally, it is equally important to ensure that certain other non-functional requirements are not overlooked in this process. There would include: security of data being transmitted, the speed and errors in transfer of data and reliability of data being

transferred. It is obvious that apart from execution of a defined task, many non-operational issues are quite significant as well.

A significant amount of present day research already exists in the field of QoS as it is perceived from a networking, telecommunications and distributed multimedia perspective. However, there is some amount of disparity between this and QoS research in the service-centric sense. Subsequent discussion is about this disparity. Quality of Service is made more explicit by analysing the way in which the term has traditionally been used and how it is being extended to suit service-oriented architectures. Potential uses of QoS in service-centric systems are also discussed.

Application of Quality of Service in MANET

QoS refers to a level of service that is satisfactory to some user. The related term Service Level Agreement (SLA) is often used to describe the agreement between the user and the service as to what constitutes 'satisfactory'. In addition to QoS agreements, an SLA may also contain agreed cost, service functionality and other agreed parameters.

Common use of term QoS originated in the fields of networking, telecommunications and distributed multimedia. However, there is no precise, uniform definition. But, it generally tends to refer to the request, specification, provision and negotiation of some or all of the following network characteristics

- Bandwidth (or throughput)
- Latency (or delay)
- Jitter
- Error Rate
- Availability (or uptime)
- Network Security

There may be further subdivisions of these properties. For example, latency may be divided into one-way or two-way and error rate into packet loss or sequence error rate. Quantification of these may be as per various metrics. For instance, jitter metrics might include the maximum difference in latency, the standard deviation of latency or some qualitative measure of the degree of variability in latency.

QML: The need for multi-category QoS spurned the need for specific modeling languages. QML, developed at HP Software Technology Lab, addresses various categories such as performance, security, reliability and timing [Miguel A. de Miguel, 2003]. It defines functional properties of software component. Additionally, it permits specification of operations, operation arguments and attributes at a very precise level. QML also has a good fit with object-oriented distribution architecture [Frolund Svend, Koistinen Jari1998] [Jing Dong Reza Curtmola Cristina Nita-Rotaru, 2008].

QML: A Language to Specify Qos Properties

Basic Requirements

The main style thought for QML is to support QoS specification in Associate in object-oriented context. We would like QML to integrate seamlessly with existing object-oriented ideas. This overall goal leads to the subsequent specific style needs for QML:

- QoS specifications ought to be syntactically break free alternative elements of service specifications, like interface definitions. This separation permits North American country to specify totally different QoS properties for various implementations of constant interface.
- There ought to be how to see whether or not the QoS specification for a service satisfies the QoS demand of a consumer. This demand could be a consequence of the separate specification of the QoS properties that clients need and therefore the QoS properties that services offer.
- QML ought to support refinement of QoS specifications. In distributed object systems, interface definitions square measure generally subject to inheritance. Since inheritance permits Associate in interface to be outlined as a refinement of another interface, and since we tend to associate QoS specifications with interfaces, we want to support refinement of QoS specifications.

Other aspects like negotiation and utility is addressed as mechanisms exploitation QML or presumably be a part of future extensions of QML. This paper focuses on the necessities listed higher than.

LITERATURE SURVEY

Work Done by Numerous Researchers Has Been Studied and a Few of the Works Are Found Relevant to the Present Work Square Measure as Follows

Huaizhou SHI, R. Venkatesha Prasad [1996], introduction of the fairness problems in wireless networking analysis. Especially the challenges in resource sharing fairness are self-addressed thorough. Raised 3 core inquiries to explore the essence of investigations with relation to fairness studies in wireless networks. Based on these queries, we tend to summarize some general analytical models of fairness and compared them. Then, fairness problems in wireless networks were classified and analyzed. We tend to conjointly given the link between fairness, utility and resource allocation.

Jing Dong Reza Curtmola Cristina Nita-Rotaru [2008] Recent add multicast routing for wireless mesh networks has targeted on metrics that estimate link quality to maximize output. Nodes should collaborate so as to cipher the trail metric and forward information. the belief that each one nodes square measure honest and behave properly throughout metric computation, propagation, and aggregation, yet as throughout information forwarding, results in surprising consequences in adversarial networks wherever compromised nodes act maliciously.

Ekaterina Dashkova and Andrei Gurtov [2010], introduction of Wireless detector networks typically expertise congestion, therefore a sophisticated congestion management resolution is needed. The CC mechanism ought to dissent from its relation deployed within the net. Plenty of analysis and solutions were printed targeted to resolve the congestion drawback in resource restricted communications. For our purpose most of them don't seem to be appropriate thanks to the fastened protocol stack and assumptions regarding configuration and quality.

SIMULATION SCENARIO

Simulation Model and Performance Metrics

Even though the performance evaluation/analysis of ad hoc routing protocols is usually measured in homogeneous network, this evaluation is not much effective in the real applications where nodes have different capabilities. To study the efficiency and the effectiveness of routing protocols in heterogeneous ad hoc networks, NS-2 simulator [Samad M. and Herman S.H.(2005)] is used to construct the simulation. The details of the simulation scenarios and performance metrics

are illustrated in the following sections.

Simulation Model

In heterogeneous ad hoc networks, each node normally has different capabilities since some nodes are portable devices with limited capacity and battery life, while the others may be stationary or equipped with vehicle. These nodes are not power-constrained and usually have higher capacity than the former one. In this research work, there are two types of nodes which are High-capacity nodes (H-nodes) and General capacity nodes (G-nodes). These two types of nodes have different capacity which are bandwidth and transmission range.

Simulation scenarios are constructed by varying number of nodes. In each scenario, a few nodes approximately 5-20% is included as malicious nodes. For example, if there are totally 50 nodes in the heterogeneous networks, 5 nodes of them are the malicious nodes while other nodes are correct nodes performing good communication practices.

PERFORMANCE EVALUATION METRICS

The performance metrics which are used to analyze the performances of routing protocols in heterogeneous ad hoc networks are discussed in the following:

- **Packet Delivery Ratio (PDR)**: The ratio of total number of packets received by destinations to total number of packets sent by sources

  ∑ Number of packet receive / ∑ Number of packet send

  The greater value of packet delivery ratio means the better performance of the protocol.

- **Average End-To-End Delay:** The average time taken by a data packet to arrive in the destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations that counted.

  ∑ (arrive time – send time) / ∑ Number of connections

  The lower value of end to end delay means the better performance of the protocol.

- **Throughput**: In data transmission, throughput is the amount of data moved successfully from one place to another in a given time period.

- **Latency**: A measure of the delay in a call. We measure both the round-trip delay between when information leaves point A and when a response is returned from point B, and the one-way delay between when something was spoken and when it was heard. The largest contributor to latency is caused by network transmission delay. One-way latency is used for diagnosing network problems.

- **Jitter**: Jitter refers to how variable latency is in a network. High jitter, greater than approximately 50 msec, can result in both increased latency and packet loss.

- **Packet Loss:** Just as it's important to hear what someone says in the order they say it, it's also important to hear all of what they're saying. If you miss one out of every 10 words or 10 words all at once, chances are you're not going to understand much of the conversation. This is packet loss some of the voice packets are dropped by network routers or switches that become congested (lost packets), or discarded by the jitter buffer

(discarded packets).

QML Specification for the Proposed System

One of the best known QoS specification techniques is QML (Quality Modeling Language), which has been proposed by Frølund and Koistinen [1998]. However, QML is focused on the specification of application layer QoS properties whereas in wireless systems it is also important to explicitly deal with hardware layer properties. Therefore this work carries the hardware specifications in QML as well so that the complete wireless system can be specified.

From the readings of the existing system, following QML specifications has been created for both case studies for the different mobile computing parameters.

- **Congestion Control**

Contract Type

Con Type: = Contract {

Packet Sent, Received Size, Packet Delivery Ratio, Throughput,

}

Dim Name: = Packet Sent;

Unit: = count;

Dim Name: = Received Size;

Unit: = bytes;

Dim Name: = Packet Delivery Ratio;

Unit: = ratio;

Dim Name:= Throught put;

Unit: = Kb/second;

Contract Instance

PDR: = Contract {

Packet Sent, Received Size, Packet Delivery Ratio, Throughput,

Constraint1, Constraint2

}

Constraint1:= Packet Delivery Ratio > 90

Packet Delivery Ratio Unit: = Ratio

THROUGH PUT: = Contract {

Packet Sent, Received Size, Packet Delivery Ratio, Throughput,

Constraint1, Constraint2

}

Constrainit2:= Throught > $Throuput_{Threshold}$

Through Put Unit:=Kb/Sec

- **Security**

Contract Type

Con Type: = Contract {

Packet Sent, Received Packets, End To End Delay, Routing Overhead, Drop Packet Rate

}

Dim Name:= Packet Sent;

Unit: = count;

Dim Name:= Received Packets;

Unit: = count;

Dim Name:= End To End Delay;

Unit: = Milli Seconds;

Dim Name:= Routing Overhead;

Unit: = Percent;

Dim Name:= Drop Packet Rate;

Unit:= Ratio;

Contract Instance

END TO END DELAY := Contract {

Packet Sent, Received Packets, End To End Delay, Routing Overhead, Drop Packet Rate

Constrain1, Constraint2, Constraint3,

}

Constraint1:= End To End Delay between 0 to 20

End To End Delay Unit:= Milli Seconds

ROUTIN GOVER HEAD := Contract {

Packet Sent, Received Packets, End To End Delay, Routing Overhead, Drop Packet Rate

Constrain1, Constraint2, Constraint3,

}

Constrainit2:= Routing Overhead Between 0 to 20%

Routing Overhead Unit:=Kb/Sec

DROP PACKET RATE := Contract {

Packet Sent, Received Packets, End To End Delay, Routing Overhead, Drop Packet Rate

Constrain1, Constraint2, Constraint3,

}

Constrainit3:= Drop Packet Rate Between 0 to 30% (depending on the mobile application)

Drop Packet Rate Unit:=Ratio

IMPLEMENTATION DETAILS

Simulation is that the execution of a system model in time that provides data a few systems being investigated. Events occur at distinct points of your time. Once the quantity of such events is finite, we tend to decision it distinct event. A distinct event machine consists of a bunch of events & a central machine object that executes these events so as.

The following items are most vital or essential to any simulation:

- An abstract framework of events
- An arrangement to manage events
- Functions to come up with random variables
- Facilities to permit objects to act

In this section, we tend to gift the simulation studies for the projected formula and therefore the IEEE 802.11e waterproof protocol. Simulation is performed on Network Simulator (NS) version 2.32.

EXPERIMENTAL SCENARIO

In this section, the simulation results for the proposed algorithm and the IEEE 802.11 MAC algorithm are given. Simulation is performed using Network Simulator (NS) version 2.32. Scenarios are created by increasing the no. of nodes. A traffic generator with CBR distribution has been used to provide offered load in this simulation. For processing of intermediate results TCL & AWK scripts have been used. The generation of results requires installation of NS2 over Ubuntu or Windows operating systems.

- **Congestion Control**

Simulation has been performed for the congestion control scenario using NS-2 (2.32) and results are drawn.

Throughput calculations from existing and proposed mechanisms

Table1.1: Throughput of the Network for With and Without Modifications in the Existing Algorithms

No. of Nodes	Throughput with Existing Security	Throughput with Modified Security
30	23.01	26.63
35	90.3	97.96
40	68.13	81.21
45	86.05	50.42
50	128.96	145.96
110	241.85	352.76

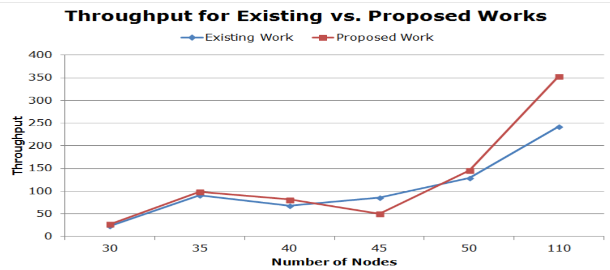

Figure 1.1: Throughput for Proposed Work vs. Existing Work

Inference: From the graph it's seen that the throughput of the proposed work is higher the existing work. For node count 45 only the graph is showing downfall of the throughput of the proposed implementation than the existing implementation which may be due to random positioning of the nodes. It is also seen that as the density of the nodes is increasing beyond 50 the growth of the throughput curve is increasing rapidly than the existing work.

Packet Delivery Ratio calculated from existing and proposed algorithms

Table 1.2: Packet Deliver Ratio of the Network for With and Without Modifications in the Existing Algorithms

No. of Nodes	Throughput with Existing Security	Throughput with Modified Security
30	95.566	95.556
35	99.3289	99.359
40	98.6486	99.0683
45	98.5748	99.648
50	99.2519	99.434
110	98.6395	99.6294

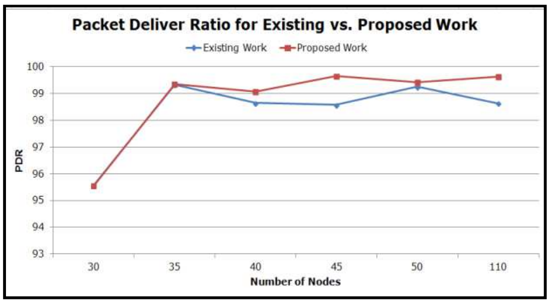

Figure 1.2: Packet Deliver Ratio for Proposed Work

Inference: From the graph it's seen that the packet delivery ratio of the proposed implementation is always higher than the existing values of the packet delivery ratio. The increase of PDR is not very much higher but still it is great for all density of the nodes. As the node density is increased the relative increase of the PDR value has also increased than the existing work.

SECURITY

Simulation is being performed for the proposed work using NS-2 (2.32) and results are drawn.

End-to-End Delay Measured using Proposed Work

Table 1.3: End To End Delay Measured Using Proposed Work

NUMBER OF NODES	DELAY(MS)
20	130.32
40	34.63
50	174.13
75	627.51
100	1436.67
200	2769.49
300	2873.21

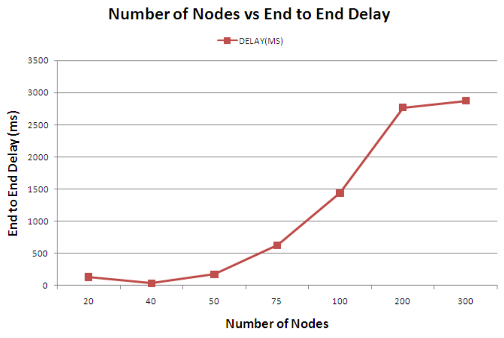

Figure 1.3: End to End Delay for the Proposed Work

The end to end delay is an indicator of how good communication links and the proposed work is showing a gradual increase in end to end delay with the increase of the number of nodes. A sudden increase in case of 200 nodes has been seen which is occurring due to placement of the nodes. A smooth decrease for 300 nodes verifies the above reason.

Routing Overhead Measured using Proposed Work

Table 1.4: Routing Overhead Measured Using Proposed Work

NUMBER OF NODES	ROUTING OVERHEAD
20	16.09
40	19.05
50	25.94
75	21.98
100	20.85
200	21.13
300	21.51

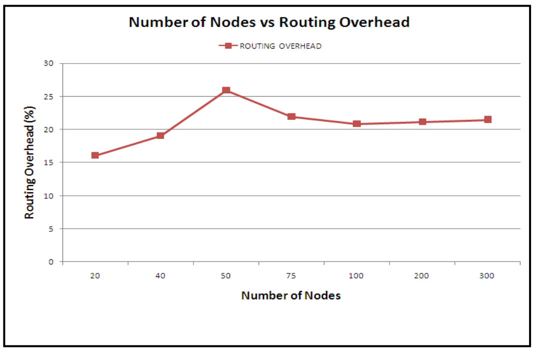

Figure 1.4: Routing overhead for the Proposed Work

Routing overhead is a measure for extra load being applied on the routing protocol and communication system. It is measured in % and from the readings and graphs it is found that the proposed work do not impose much routing overhead on the system. Even when the number of nodes are too many, the routing overhead is under control and do not show any abnormal growth.

Date Packet Rate Measured using Proposed Work

Table 1.5: Drop Packet Rate Measured Using Proposed Work

NUMBER OF NODES	DROP PACKET RATE
20	13.32
40	31.66
50	15.41
75	16.83
100	13.32
200	17
300	15.24

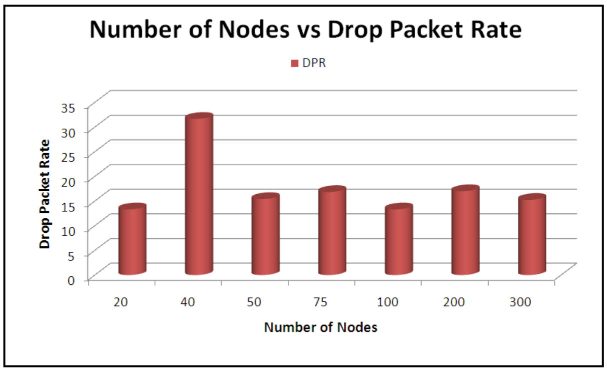

Figure 1.5: Routing overhead for the Proposed Work

Data packet rate is a measure for the amount of packets drop rate during the communication

Packet lost = Number of packet send – Number of packet received

Packet Drop Rate = Average Difference of Packets Received and sent

The lower value of the packet lost means the better performance of the protocols.Data packet rate is being applied on the routing protocol and communication system. It is measured in % and from the readings and graphs it is found that

the proposed work low data packet rate on the system. Even when the number of nodes are too many, the routing overhead is under control and do not show any abnormal growth.

Comparison between the Existing Work & Proposed Work

Table 1.6: Drop Packet Rate Measured Using Proposed Work

NUMBER OF ATTACKERS	S-ODMRP	ODMRP-HT	PROPOSED
2	76	78	86
4	72	68	70
5	70	62	84
8	66	59	83
10	64	56	87
20	58	42	83

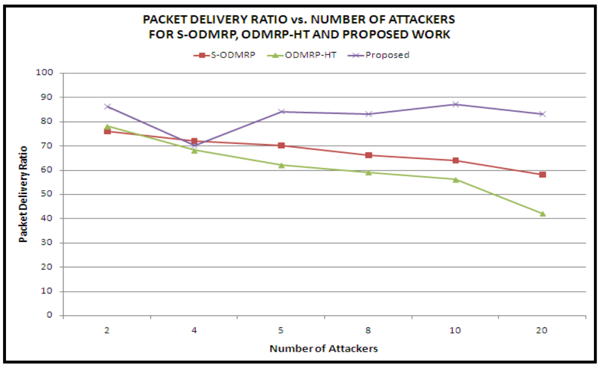

Figure 1.7: Comparison between the Proposed Work & Existing Work

From the graph it is clear that the packet delivery ratio of the proposed work is higher than the existing works in the base paper.

CONCLUSIONS

We planned a theme for congestion management and high security in mobile wireless networks to check and check the inclusion of QoS parameters. For testing, management and management of QoS, QML specifications are created initially. The QML specifications offer a final analysis for achieving the standard of the new system however additionally offer their intact operating in several situations. We've got evaluated totally different mobile wireless network metrics on the idea of the QML specifications victimization the planned models of the 2 different case studies. The numerical and simulation results show that modifications planned within the case studies are having high impact on the performance and quality of the mobile wireless systems. The influence of the parameter variations in several topological changes are simulated characterization of those has been done accurately and beneath the boundaries of the QML specifications.

FUTURE WORK

While during this work we have a tendency to investigate QoS provisioning, our developed technique are often without delay extended to situations with real time applications of the mobile wireless networks like Wireless sensing element Networks (WSN), Manet (Mobile Adhoc Networks) etc. additional vital, our developed technique additionally offers a sensible and effective approach to develop extremely economical schemes to ensure QoS for period of time traffic over mobile wireless networks.

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